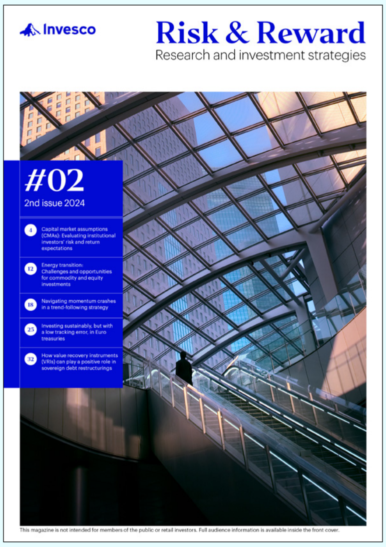
Investing sustainably, but with a low tracking error, in Euro treasuries

By Khanika Gadzhieva, Reed McDonnell, James Ong, CFA®, and Nancy Razzouk, CFA®



In its 35th year, Risk and Reward provides a platform for Invesco's investment professionals to produce original research and investment strategy content. This Q2 2024 edition contains four additional articles. Contact your local Invesco representative for the full edition.

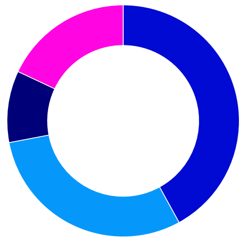
We propose a unique approach to incorporating environmental, social, and governance (ESG) objectives in a Euro treasury portfolio: maximizing the share of green bonds while minimizing tracking error to the Bloomberg Euro Aggregate Treasury Index. The method offers a risk profile similar to the benchmark, but with significantly better ESG characteristics.

Green bonds are fixed income securities that finance projects with environmental benefits, including large-scale initiatives aimed at mitigating climate change or promoting sustainability. Structurally similar to traditional bonds, green bonds can be issued by central governments (treasuries) as well as government-related entities such as local authorities, agencies, or intergovernmental organizations.

In the euro area, 58% of all green bonds, by market value, are issued by government-related issuers – and only 42% by central governments (figures 1 and 2). Non-treasury, government-related issuers include large, well-known agencies and supranationals such as the European Union, the European Investment Bank (EIB), and the German state-owned development bank KfW. All three rank among the top five issuers, closely behind France and Germany.

Figure 1
Composition of the Euro green bond market (by market value)
58% of green bonds are government-related

Treasuries	42%
Agency	30%
Local Authority	10%
Supranational	18%



Source: Bloomberg L.P., Invesco. Data as of February 29, 2024. Green bonds as included in the treasury and government-related bonds segment of the Bloomberg Euro Aggregate Index.

About risk: The value of investments and any income will fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested. Diversification does not ensure a profit or protect against loss.

Figure 2
Two examples of green bond-financed projects

Federal Republic of Germany
Green Bond Framework by the Federal Republic of Germany

- **Total amount allocated:**
14.6 bn EUR in 2022

- **Example of disbursement:**
Research and innovation project investigates how to compensate for fluctuations in electricity supply related to the increasing share of renewable energies. The project is conducted by SynErgie, a Kopernikus Project in cooperation with industrial partners.

European Investment Bank (EIB)
Climate Awareness Bond Framework by the European Investment Bank

- **Total amount allocated:**
12.7 bn EUR in 2022

- **Example of disbursement:**
Investments in the energy-efficient modernization of office buildings and the construction of nearly-zero energy buildings (NZEB). The project contributes to the reduction of energy use and greenhouse gas (GHG) emissions as well as the promotion of the concept of energy building standards in Spain.

Source: German Federal Agency of Finance (Green Bond Project Allocations), European Investment Bank (Climate Awareness Bond Allocations).

“

We must be aware of the different risk profiles of green and traditional bonds.

“

The median duration of Euro green treasuries is nearly twice as long as that of their non-green counterparts.

Green treasuries are different, and so are green government-related bonds
The Bloomberg Euro Aggregate Treasury Index, which is used by the largest index-based ETFs, consists of bonds issued by eurozone governments with at least a one-year maturity. On February 29, 2024, green treasuries represented only 2.6% of its total market value of EUR 7.4 billion, suggesting significant potential for expansion. To understand the risks of increasing the green bond share of a portfolio tracking this index, we must be aware of the different risk profiles of green and traditional bonds.

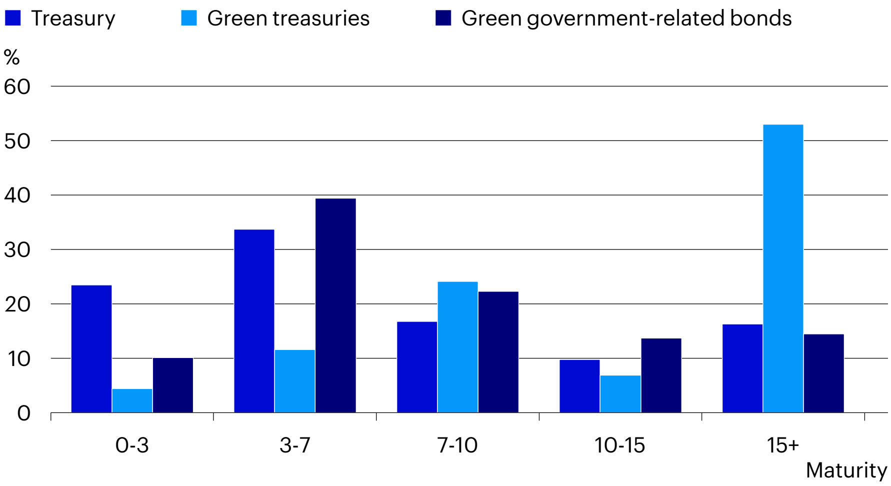
Duration, or interest rate risk, is the predominant performance driver, accounting for about 84% of the index return.[1] However, at 12.5 years, the median duration of Euro green treasuries is nearly twice as long as that of their non-green counterparts (6.8 years).[2] Figure 3 shows that over half the green bond market has a maturity of more than 15 years. Including more green treasuries therefore leads to a higher duration risk.

Country of issuance is another risk factor. Economic, political, or financial instability in a particular country can impact the performance of its bonds, making country exposure an important consideration. Although the country distribution of traditional and green treasuries is largely similar, the median duration of green treasuries is significantly higher in all countries (figure 4). This is particularly relevant for countries with small index weights, as adding a meaningful number of green treasuries would disproportionately increase these countries' duration contribution and drive up the tracking error.

Government-related green bonds, however, may allow for more effective duration management, as their median durations deviate less from those of traditional treasuries and they offer better diversification due to a greater variety of maturities.

Moreover, it is important to consider that the composition of the green bond market changes over time. Initially, almost all

Figure 3
Euro government bonds by maturity bucket



Source: Bloomberg Euro Aggregate Treasury Index as of February 29, 2024.

Figure 2
Two examples of green bond-financed projects

	Country Weights			Median OAD		
	Traditional treasuries	Green treasuries	Green government-related bonds	Traditional treasuries	Green treasuries	Green government-related bonds
France	24.0%	25.8%	16.5%	7.9	17.3	7.8
Italy	21.8%	16.4%	3.4%	5.7	8.9	4.6
Germany	18.5%	25.8%	21.9%	5.4	7.4	4.9
Spain	14.2%	4.0%	2.6%	6.6	16.1	3.9
Belgium	5.2%	8.1%	1.3%	8.7	10.3	7.3
Netherlands	4.4%	9.8%	10.6%	7.6	14.9	6
Austria	3.5%	5.0%	0.6%	7.9	11.9	2.3
Ireland	1.7%	5.2%	0.5%	8	10.7	9.4
Other	6.7%	0.0%	42.6%	–	–	–
Total	**100.0%**	**100.0%**	**100.0%**	**6.8**	**12.5**	**5.2**

Source: Bloomberg L.P., Invesco. Data as of February 29, 2024. Figures refer to the subsegments of the Bloomberg Euro Aggregate Index. "Other" refers to countries which do not issue green treasuries. Due to rounding, figures may not add up to 100%.

green bonds were issued by government-related entities, with sovereign issuers entering only later.[3] Here again, incorporating government-related issuers helps better account for the dynamic nature of the green bond market.

How would a pure green treasury index have performed?

Before creating an ESG strategy that minimizes tracking error against the benchmark, we first need to consider a portfolio consisting only of green treasuries, with no risk controls. As mentioned, green treasuries have a higher average duration than the index. Thus, a simple strategy tracking a pure green bond index (such as the iBoxx EUR Eurozone Sovereigns Green Bonds Capped Index or the Solactive Euro Government Green Bond Index) would diverge when interest rates change. As figure 5 shows, this has been especially true since 2022, when interest rates began to increase dramatically. In the three years from February 2021 to February 2024, market value-weighted green treasuries returned -26.7% compared to -15.0% for the benchmark index, resulting in a sizable tracking error (p.a.) of 6%.[4]

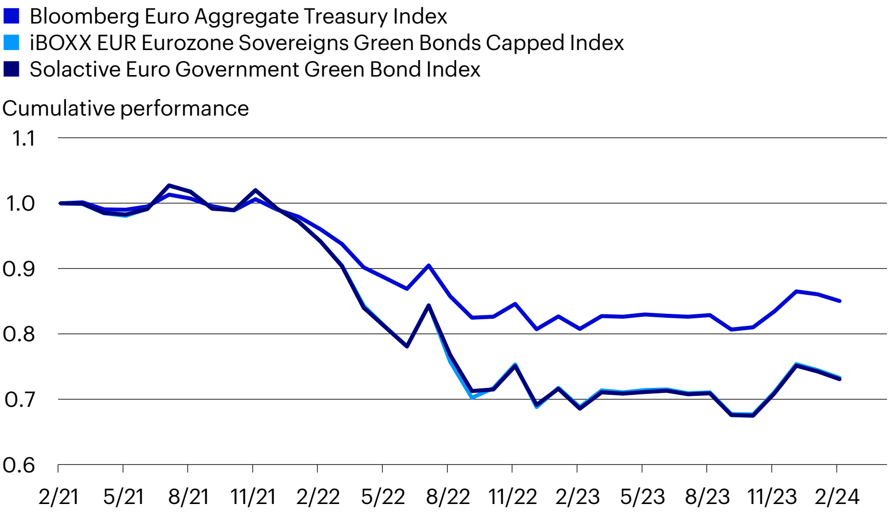
In the next section we present a simple index-based approach for reducing tracking error.

Tracking error reduction I: simple index-based approach

The first method we use to reduce tracking error begins by dividing the EUR treasury index into buckets, based on country of issuance and maturity. Then, we increase the weight of green treasuries in each bucket while keeping the weight of the buckets constant. Within this framework, the overall green treasury allocation is increased in increments of 10 percentage points.

Figure 6 shows that a 10% green treasury allocation leads to country weights in line with the index. But the duration contribution

Figure 5
Performance in comparison



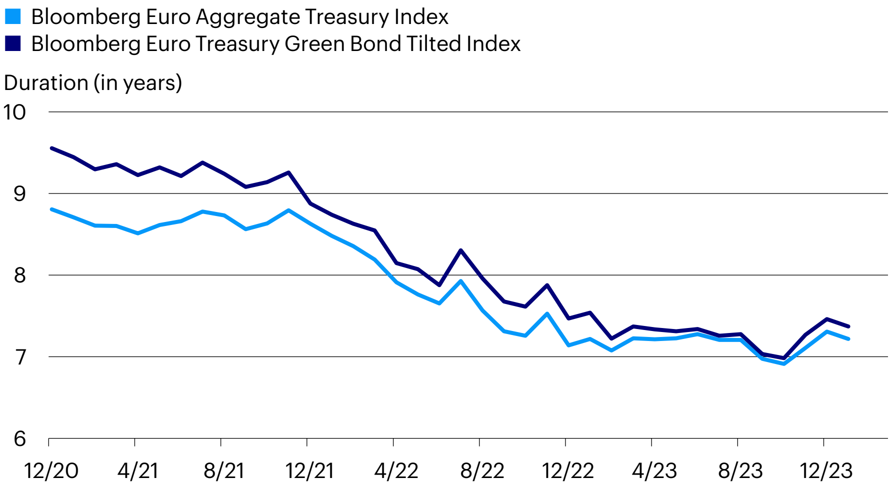
Source: Bloomberg L.P., Invesco. Data as of February 29, 2024.

Figure 6
Simulated characteristics of a simple green treasury-tilted strategy

Target green bond share	10.0%				20.0%				30.0%				40.0%			
Achieved green bond share	10.0%				19.9%				29.3%				37.9%			
	Wgt (%)	New Wgt (%)	OAD	New OAD	Wgt (%)	New Wgt (%)	OAD	New OAD	Wgt (%)	New Wgt (%)	OAD	New OAD	Wgt (%)	New Wgt (%)	OAD	New OAD
	100.0	100.0	7.28	7.21	100.0	100.0	7.28	7.20	100.0	100.0	7.28	7.33	100.0	100.0	7.28	7.49
France	23.9	23.9	1.79	1.73	23.9	24.2	1.79	1.72	23.9	24.6	1.79	1.82	23.9	24.5	1.79	1.87
Italy	21.8	21.8	1.40	1.40	21.8	21.7	1.40	1.39	21.8	21.3	1.40	1.37	21.8	21.5	1.40	1.41
Germany	18.5	18.5	1.36	1.38	18.5	18.4	1.36	1.42	18.5	18.1	1.36	1.45	18.5	18.5	1.36	1.55
Spain	14.2	14.2	0.99	0.99	14.2	14.1	0.99	0.99	14.2	13.9	0.99	0.97	14.2	13.5	0.99	0.95
Belgium	5.2	5.2	0.46	0.45	5.2	5.2	0.46	0.44	5.2	5.4	0.46	0.43	5.2	5.4	0.46	0.40
Netherlands	4.4	4.4	0.36	0.34	4.4	4.4	0.36	0.35	4.4	4.5	0.36	0.37	4.4	4.5	0.36	0.38
Austria	3.5	3.5	0.31	0.30	3.5	3.5	0.31	0.28	3.5	3.6	0.31	0.31	3.5	3.6	0.31	0.32
Portugal	2.0	2.0	0.14	0.14	2.0	2.0	0.14	0.13	2.0	2.0	0.14	0.13	2.0	1.9	0.14	0.13
Ireland	1.7	1.7	0.13	0.13	1.7	1.7	0.13	0.14	1.7	1.9	0.13	0.15	1.7	2.0	0.13	0.16
Finland	1.5	1.5	0.12	0.12	1.5	1.5	0.12	0.12	1.5	1.5	0.12	0.11	1.5	1.5	0.12	0.11

Source: Bloomberg L.P., Invesco. Data as of February 29, 2024.

Figure 7
Duration differences between a traditional index and one with a 30% green bond tilt



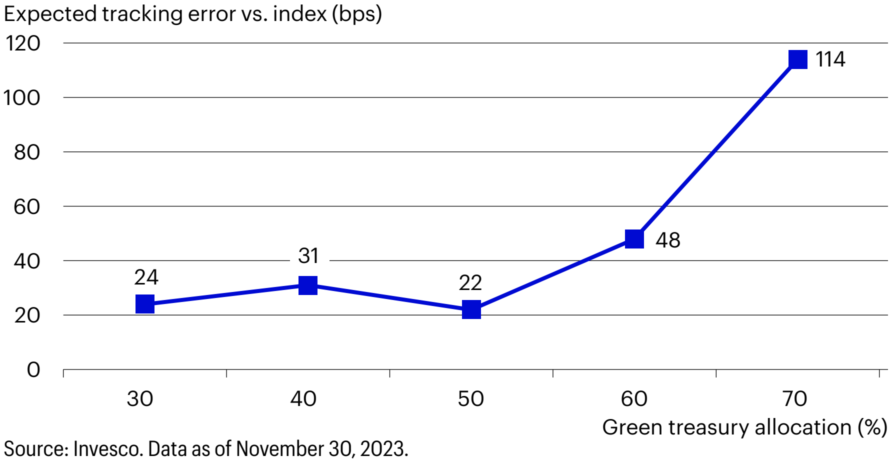
Source: Bloomberg L.P., Invesco. Data from December 31, 2020 to January 31, 2024. **Past performance does not guarantee future results. An investment cannot be made directly in an index.**

of France is noticeably lower, making the overall duration of the strategy lower than that of the index. Beyond 10%, country weights start diverging from the index and at the same time it becomes more difficult to maintain the desired green allocation. With a 29% green treasury allocation, the overall duration of the strategy comes closest to the index duration. Clearly, a simple index-based approach that tilts to green treasuries within risk buckets fails to deliver a constant green treasury allocation with consistent country and interest rate risk exposures.

Furthermore, the quality of the results can vary over time as the composition of the green bond market evolves. This is evidenced by the Bloomberg Euro Treasury Green Bond Tilted Index, which seeks to maintain a 30% allocation to green bonds while controlling for country weights. Despite the consideration of duration exposures, the primary objective remains focused on green treasury and country allocations by market value. Consequently, when the trade-off between maintaining a 30% green bond share and managing duration exposures cannot be resolved, the strategy tends to compromise on its duration exposure, as shown in figure 7.

These results show a conflict between significantly increasing the green bond share and aligning the portfolio's duration with the index, both at the country level and overall. This is important since duration, or interest rate risk, is the primary driver of risk in a government bond strategy and aligning country exposures based solely on market value is not sufficient to address these risks. Therefore, our strategy puts particular emphasis on managing duration exposures while significantly increasing the green bond share.

Figure 8
Expected tracking error of different green treasury allocations



Source: Invesco. Data as of November 30, 2023.

“

A more sophisticated approach is required.

Tracking Error reduction II: active systematic approach
Given these drawbacks, a more sophisticated approach is required. An active, systematic strategy aimed at creating a portfolio that maximizes green bond allocation while effectively managing the primary risk drivers may be the answer. The proposed approach differs from an index-based approach in two important ways: (1) controlled key risk drivers and (2) the use of government-related green bonds.

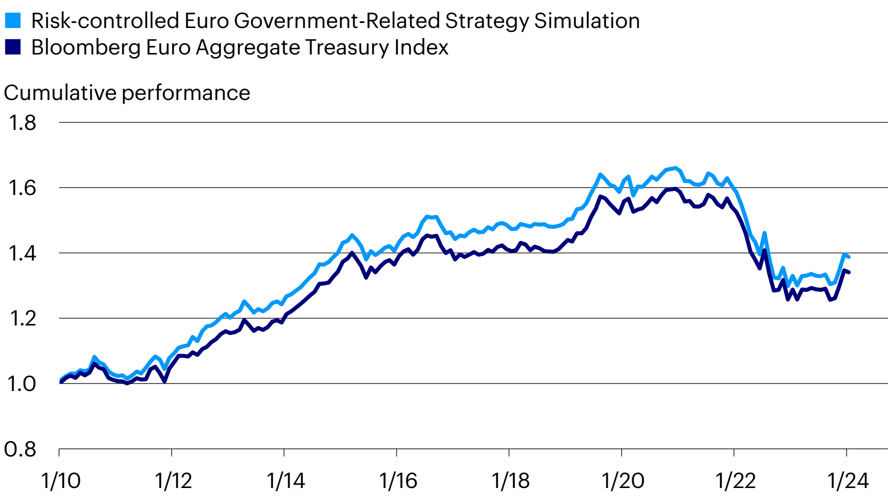
Controlling key risk drivers
Our systematic approach aims first to manage the main risk drivers in the Euro treasury market, defined by the country of issuance and the duration curve. This strategy applies tight controls on aggregate duration and aims to minimize deviations along the curve. The country allocation, meanwhile, is not constrained to track the index as closely as in the index-based approach. Although country allocation and country duration contributions are controlled, the constraints are more relaxed.

To determine the desired level of green treasury allocation, we run several optimizations, adding 10 percentage points with each iteration while matching the risk characteristics according to the method described above. We observe that, with a green treasury allocation of more than 50%, the expected active risk increases significantly, as shown in figure 8.

Therefore, through the first element of our approach, we can increase the green bond share to 50% using green treasuries only.

Incorporating green government-related bonds
But remember that there are only a few green treasuries, with large issue amounts and long durations, but far more government-related green bonds, with

Figure 9
Simulated performance of a risk-controlled Euro government-related strategy vs. the Bloomberg Euro Aggregate Treasury Index
Cumulative performance of a simulated EUR-denominated government-related bond strategy that targets the interest rate and credit risk of the Bloomberg Euro Aggregate Treasury Index



Source: Bloomberg L.P., Invesco. Data from January 31, 2010 to January 31, 2024. **There is no guarantee that the simulated performance will be achieved in the future.**

Green bonds are the best way to integrate investor sustainability preferences in Euro treasuries.

shorter durations on average. Adding these significantly expands our opportunity set. This distinguishes our concept from a passive or index-based approach and helps investors achieve the two goals of attaining the desired green bond share and matching the main risk characteristics of the index.

We now allocate up to 10% to European government-related green bonds. The interest rate and country risk controls described above are still effective since the main risk driver of government-related bonds is also duration risk. In fact, government-related bonds closely align with the EUR treasury bond index when controlled for duration and spread risk as shown in figure 9.

Adding government-related green bonds with effective risk controls helps diversify the opportunity set and allows investors to maintain high levels of green bond exposure without subjecting the strategy to undesired risks. The proposed systematic portfolio construction strategy, coupled with the active management of the green bond allocation and related risk imbalances, helps achieve a consistently high green bond share while matching the risk characteristics of the index.

Summary

We believe green bonds are the best way to integrate investor sustainability preferences in Euro treasuries. However, sustainability-minded investors seeking to avoid excessive risks compared to a passive replication of the Bloomberg Euro Aggregate Treasury Index will likely face several challenges given the features of the European green bond market – namely the longer duration of green bonds, which increases their interest rate risk, and the prevalence of government-related green bonds, which are not part of the index. Moreover, the structure of the green bond market varies over time, meaning that sector and maturity compositions change as the market evolves.

All this adds to the problem of how to increase a portfolio's green bond share while controlling risk. Index-based approaches seem poorly suited to solve this multidimensional problem, so that investors seeking to increase their green bond allocations with low tracking error against the index may be better served by an active and systematic approach – systematic, to deal with the multidimensionality of the problem, and active, to accommodate the dynamic nature of the green bond market.

Notes

1 The total return of the Bloomberg Euro Aggregate Treasury Index was regressed on the duration component of total return. Bloomberg data from Jan. 1, 2000 to Feb. 29, 2024.
2 Bloomberg, as of February 29, 2024.
3 Baker et al. (2018).
4 Source: Invesco. February 28, 2021 – February 29, 2024.

The performance results shown are hypothetical (not real) and were achieved by means of the retroactive application of the statistical model. It may not be possible to replicate the hypothetical results. The simulation is for informational and educational purposes only and is not an offer of any investment product.

References

Baker, M., D. Bergstresser, G. Serafeim, and J. Wurgler (2018): Financing the Response to Climate Change: The Pricing and Ownership of US Green Bonds. NBER Working Paper 25194.

ICMA (2018): Green and Social Bonds: A High-Level Mapping to the Sustainable Development Goals.

Ozdemiroglu, E., and G. Duke (2019): Demystifying Green Finance, Valuing Nature Paper VNP21.

Baldi, F., and G. Ferri (2022): Public Sector Green Bonds. What Drives Proceeds Investments and Performance?

Swinkels L. (2022). Allocating to Green Bonds. The Journal of Alternative Investments.

About the authors

Khanika Gadzhieva
Portfolio Management Associate
Invesco Quantitative Strategies
Khanika Gadzhieva, along with the Global Portfolio Analytics team, conducts performance and risk analytics for various MAS strategies with a focus on fixed income factor strategies.

Reed McDonnell
Quantitative Analyst, Fixed Income Factors
Reed McDonnell works with the research, portfolio management, and technology teams to implement systematic factor strategies across global credit, currencies, interest rates, and ESG.

James Ong, CFA®
Senior Portfolio Manager, Fixed Income Factors
James Ong is responsible for management of portfolios, as well as research focusing on macro investment.

Nancy Razzouk, CFA®
Associate Portfolio Manager, Fixed Income Factors
Nancy Razzouk is responsible for implementing systematic credit strategies, factor and ESG research, and portfolio construction.

About risk
The value of investments and any income will fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested.

Important information

www.invesco.com

II-GIRR-BRO4-2-E GL3596790/3617556/2024